

[0037] In a user interface feedback apparatus in accordance with another embodiment of the present invention, the sensor acquires and provides to the processing unit pressure information regarding the user contact site. The processing unit then determines the parameters of the electrical signal in accordance with the pressure information regarding the user contact site acquired from the sensor.

[0038] In a user interface feedback apparatus in accordance with another embodiment of the present invention, the sensor acquires and provides to the processing unit position information regarding the user contact site. The processing unit then determines the parameters of the electrical signal in accordance with motion information regarding the user contact site that is obtained on the basis of the position information regarding the user contact site acquired from the sensor.

[0039] In a user interface feedback apparatus in accordance with another embodiment of the present invention, the operable element is configured as a two-dimensional plane. The sensor detects the user contact position on the two-dimensional plane in the form of user contact information with respect to the operable element. The processing unit then determines parameters for an electrical signal to be output to the conductor in accordance with the user contact position on the two-dimensional plane.

[0040] In a user interface feedback apparatus in accordance with another embodiment of the present invention, the operable element is configured as a one-dimensional element. The sensor detects the user contact position on the one-dimensional line in the form of user contact information with respect to the operable element. The processing unit then determines parameters for an electrical signal to be output to the conductor in accordance with the user contact position on the one-dimensional line.

[0041] In a user interface feedback apparatus in accordance with another embodiment of the present invention, the sensor detects the user contact position according to electrostatic capacitive coupling.

[0042] In a user interface feedback apparatus in accordance with another embodiment of the present invention, the sensor is configured to include an optical sensor, an electrical sensor, a camera, or a pressure sensor.

[0043] A user interface feedback apparatus in accordance with another embodiment of the present invention is also earth-grounded in order to make the electrical potential of the user equal to the ground potential.

[0044] A user interface feedback apparatus in accordance with another embodiment of the present invention includes: an operable element having a many-layered structure made up of a display module, a transparent conductor, and a transparent insulator; a sensor configured to detect, in the form of user contact information, at least a user contact position with respect to the insulator of the operable element; a processing unit configured to acquire user contact position information in the form of the detected information from the sensor, and determine parameters for an electrical signal to be output to the conductor according to relationship between the user contact position and a display position with respect to the display module; and a tactile control module configured to control the frictional force between the insulator and the user by outputting to the conductor an electrical signal regulated by the parameters determined by the processing unit.

[0045] A user interface feedback method in accordance with another embodiment of the present invention is executed in an information processing apparatus, the method including

the steps of: causing a sensor to detect, in the form of user contact information, at least a user contact position with respect to an insulator constituting part of an operable element having a two-layer structure made up of a conductor and an insulator; causing a processing unit to acquire the detected information from the sensor, and determine parameters for an electrical signal to be output to the conductor; and causing a tactile control module to control the frictional force between the insulator and the user by outputting to the conductor an electrical signal regulated by the parameters determined by the processing unit.

[0046] A program in accordance with another embodiment of the present invention causes user interface feedback processing to be executed in an information processing apparatus, the program including the steps of: causing a sensor to detect, in the form of user contact information, at least a user contact position with respect to an insulator constituting part of an operable element having a two-layer structure made up of a conductor and an insulator; causing a processing unit to acquire the detected information from the sensor, and determine parameters for an electrical signal to be output to the conductor; and causing a tactile control module to control the frictional force between the insulator and the user by outputting to the conductor an electrical signal regulated by the parameters determined by the processing unit.

[0047] The program in accordance with an embodiment of the present invention is providable in computer-readable format via a storage medium or communication medium to a general-purpose system capable of executing various program code, for example. By providing such a program in a computer-readable format, processing in accordance with the program is realized on the computer system.

[0048] Further features and advantages of the present invention will become apparent upon reading of the following detailed description of exemplary embodiments in conjunction with the attached drawings. In the present specification, a system refers to the logical assembly of a plurality of apparatus, and is not limited to respective apparatus being housed in a single physical unit.

[0049] According to an embodiment of the present invention, an apparatus that provides user interface feedback to a user is realized. An operable element is configured having a two-layered structure of a conductor and an insulator. At least a user contact position with respect to the insulator of the operable element is detected by a sensor, in the form of user contact information. On the basis of the information detected by the sensor, parameters for an electrical signal to be output to the conductor are determined. More specifically, voltage values and a frequency for an alternating voltage are determined. The electrical signal thus determined is then output to the conductor. As a result of such a configuration, different frictional forces are produced between the user's fingertip and the insulator by means of a variety of electrical signals. In so doing, the user is able to experience a variety of different types of user interface feedback.

BRIEF DESCRIPTION OF THE DRAWINGS

[0050] FIG. 1 illustrates an exemplary configuration of a tactile display having an electrode pattern;

[0051] FIG. 2 illustrates the configuration of a user interface feedback apparatus in accordance with an embodiment of the present invention;

[0052] FIG. 3 illustrates an exemplary configuration of a user interface feedback apparatus in accordance with an